The Future of Internet Technology

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***Abstract*—The 1990s saw the emergence of Web 1.0, representing the origin of the Internet. This was made up of static, read-only web pages created exclusively by a few developers. Initially, it was one of the greatest advances the world had ever seen, as anyone could access published content [1]. However, users could only read and browse these web pages, but could not interact with them. In addition, there were no search engines available during interaction and browsing the internet was not a simple practice [2].**

By the 2000s, Web 2.0 emerged. Its first iteration involved a single flow of information from the web publisher to the user, but its more advanced version allows significantly more interaction and participation. For example, users could generate their own accounts to have unique identities within the network [3]. This aspect involved great benefits for businesses and for e - commerce, because they could cost-effectively market their products to a worldwide base of potential consumers online.

This made it easier for anyone to publish content on the internet, giving rise to the trend of blogs and user-published information sites such as Wikipedia. In addition, Web 2.0 developed and brought with it the rise of social networking sites such as Facebook, Twitter and YouTube. The development of web technologies such as JavaScript, HTML5(Hyper Text Markup Language 5) and CSS3(Cascading Style Sheets 3) during this time was fundamental in the construction of these interactive web platforms [4].

For some time now, there is a paradigm of developing the next level, Web 3.0. This would be a decentralised web that represents the latest generation of internet applications and services powered by distributed accounting technology, the most common being the block chain [5]. In other words, a more open, intelligent and autonomous web.

***Index Terms*—block chain, autonomous, paradigm, decentralised, distributed.**

I. Introduction

Web 3.0 promises to build the next internet in the block chain, but not everyone is on board with the concept. It seemed difficult enough to escape the hype surrounding term. Web 3.0 is often referred to as the next generation of the internet built using block chain and crypto currency technologies.

Those fronting this new shift claim that Web3 will enable digital ownership over content and art, bringing an end to the middlemen — big tech companies such as Amazon, Google, Meta(Facebook), Apple. However, there seems to be no shortage of critics and sceptics that argue that this system is fundamentally flawed and poses a threat to the freedom and openness of the internet.

Before going into the controversies surrounding Web3, it is important to firstly dissect and understand what it really is and what it promises. Simply put, Web 3.0 is an idea for a version of the Internet that is fully decentralized and based on peer-to-peer technologies such as public block chains [6]. Web 3.0 will be deployed in the form of decentralized platforms and applications running on block chain technology. These applications bare owned and built by users themselves and will allow anyone to participate without monetizing their data.

The term Web3 was first used by Polkadot creator and Ethereum co-founder Gavin Wood back in 2014 and it has become an umbrella word that brings together ideas all aimed at eliminating middlemen on the internet.

The existing version of the internet, web 2.0 is host to platforms that are mostly owned and controlled by singular and private entities — companies such as Amazon, Reddit, Google and Meta. While people can interact with these platforms as customers or users, the owners of the platforms have the final say in terms of the rules and who can have access to participate [7]. More importantly, by choosing to become an user, people will automatically be subject to either digital advertising or data collection.

On the other hand, Web 3.0 offers a fairer and more equitable system. Any user is eligible to take ownership(full or partial) of a decentralized platform and even participate in its governance [8]. In this case, ownership is represented by crypto graphic tokens or crypto currencies.

One of the biggest advantages of Web 3.0 applications is that they can store data on a decentralized block chain instead of having databases stored on a handful of servers and this system enables users to have access to greater transparency and insight into how the platforms works, while also eliminating the single points of failure that Google and Amazon servers are prone to [9]. Imagine a bank that never experiences system downtime or a social media platform that is free from regulatory and governmental censorship. In short, through decentralization, Web 3.0 promises resistance to censorship, zero downtime plus increased transparency [10].

II. Comparison Between Host Addressing Technology Developments

A. *Host Addressing Methods in Present Moment*

The current Internet architecture is based on using IP addresses in two distinctive roles :

- From the network point of view, an IP address names the current topological location of an interface by which a host is attached to the network. That is, an IP address is used as a name for the location where a specific network interface can be found. If a host moves around and attaches its network interface to a different location, the IP address associated with the interface changes [11]. This role is often called the locator role.

- From an application point of view, an IP address identifies a host. That is, an IP address is used as an identifier for the peer host. It is expected that this identifier remains stable as long as the association is active. This role is often called the identifier role.

Due to increasing mobility and multi-homing requirements, together with other issues like IPv4 address scarcity, this dual role of IP addresses is becoming problematic. The generic phenomenon was previously studied by the IRTF NameSpace Research Group (NSRG), and the questions studied there are outside of the scope of this group.

B. Probable Host Addressing Method in The Future

The Host Identity Protocol (HIP) has been developed alongside the IETF and the IRTF for a few years. Its development has been partially based on the discussions that took place within the NSRG. Basically, HIP is a concrete proposal for adding a new name space to the TCP/IP stack. The new name space consist of Host Identifiers, which are crypto graphic public keys. The HIP architecture adds a new layer between the IP layer and the transport layer, thereby decoupling the layers from each other, and splitting the dual roles of IP addresses.

This new protocol brings multiple benefits to the systems that implement it. Firstly, it introduces easy-to-con-figure host-to-host IPsec security, making secure communications much easier to deploy than today. Secondly, it integrates IP-level mobility and multi-instance IPv4 and IPv6, allowing a host to have several mobile interfaces simultaneously, and to mix and match IPv4 and IPv6 as it wishes. Furthermore, it allows most IPv4 applications to directly talk to IPv6 applications, and vice versa [12].

III. Comparison Between Network Stack Developments

A. Layering Network Stack Technology in Present Moment

In the current model of the network stack, interfaces and links on the software layer build on the devices in the hardware layer. More specifically, a hardware device instance in the hardware layer has a corresponding link on the data-link layer and a configured interface on the interface layer [13]. This relationship among the network device, its data link, and the IP interface is illustrated in the figure on top of this page.

In the given model, a one-to-one relationship exists that binds the device, the data link, and the interface. This relationship means that network configuration is dependent on hardware configuration and network topology. Interfaces must be reconfigured if changes are implemented in the hardware layer, such as replacing the NIC or changing the network topology.

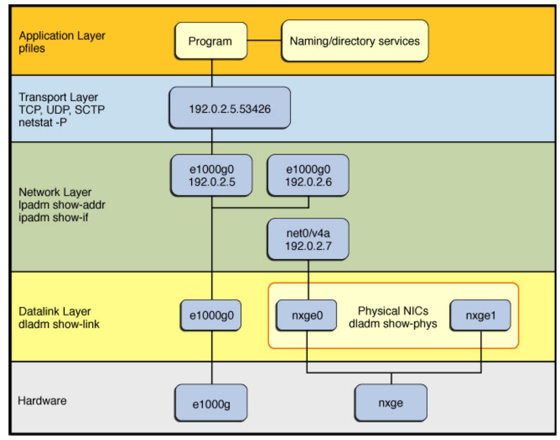

Fig. 1. Network Stack Showing Network Devices, Links, and Interfaces

B. Probable Future For Layering Network Stack Technology

Layering in the network stack seems to be having difficulties in adjusting to new protocols and services, as evidenced by the large and ever growing interest in cross-layer design over the last few years. This may be caused by problems with the current implementation of layering within the network stack, or with the layering design pattern. When a cross layer approach is broken down, it is simply a new ordering of the network stack [14]. Layering is still present within the network stack, which is simply re-ordered.

This implicit knowledge and interlinking was primarily the result of performance optimizations in the early days of networks, which blurred boundaries between layers and tightly coupled them in order to gain more data throughput. Fundamentally, this has not changed in over twenty years. the network stack has become a sacred of sorts, it is tweaked here and there from time to time(TCP Reno, New Reno, IPv4 to IPv6), but in essence it remains unchanged.

IV. Comparison Between Routing Protocols

Routing protocols determine how user data gets to its destination and helps to make that process as smooth as possible [15]. However, there are many different types of routing protocols that it can be very difficult to keep track of all of them.

A. Currently Implemented Routing Algorithms and Methods

For instance, The Bellman-Ford and Dijkstra algorithms both include a calculation of the cost (distance) of traversing a link. The main difference between the methodologies is that the cost calculations for Bellman-Ford can be positive or negative, but Dijkstra only operates in the positive. Other differences are that Bellman-Ford only informs neighboring devices but includes calculations of the cost to non-neighbors, while Dijkstra will broadcast to all but only frame its calculations in terms of cost to neighbors [16].

Another is called the Longest Prefix Matching rule. The rule is to find the entry in a routing table which has the longest prefix matching with the incoming packet's destination

IP address and forward the packet to the corresponding next hope. Since prefixes might overlap(this is possible as classless addressing is used everywhere), an incoming IP address's prefix may match multiple IP entries in a table.

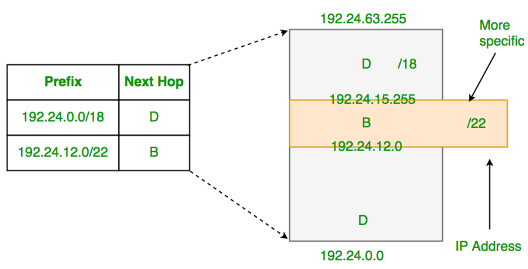

Fig. 2. An Illustration of The Longest Prefix Match Method

As of right this moment, pretty open. BGP(Border Gateway) is pretty entrenched in its own design space(inter-domain routing). There are no serious competitors, tho several have tried, and not a lot of serious problems (other than security!) that need to be addressed. And security is covered by BGPsec. BGP has also been picked up to help deal with routing in the data center, for folks with extra large leaf-spine or Cisco network topologies [17]. It is not going anywhere anytime soon.

That said, there are gradual evolutions of BGP. The protocol is extended, adding new features(support for new address families, extra information to base routing policy decisions on), but the core of how it functions is very unlikely to change unless something about the Internet changes in a way that BGP cannot cope with at which point, some disruption may well be welcomed in exchange for stability on the other side.

B. Probable Future Routing Protocol

The current internet routing technology is not capable of supporting the continuous growth of traffic and the high bandwidth demands of multimedia applications. The future internet protocol will need to be able to support applications by increasing router performance and providing some guarantees regarding the quality of service the application receives. Below are examples of routing technologies that are currently under development however may be able to be deployed in the future.

ARIS is a network routing protocol developed by IBM. It can be implemented into IP subnets and uses the standard routing protocols to establish switched paths through a network. An Integrated Switch Router(ISR) is implemented with IP routing capability and the ARIS protocol. An ISR at the edge of a network has a next hop routing table that is extended to include a reference to a VC. Each VC may have an endpoint at a neighbouring router or it may transverse a series of ISRs along the best IP forwarding path to an egress ISR. Datagrams can now be switched through hardware in an ISR network. ARIS ensures that only a few VCs are set up due to its routing base and ability to merge VCs and that all IP traffic is switched. It is also capable of multiprotocol support and can be extended to other switching environments.

NetFlow Switching is Cisco Systems' software upgrade for its existing routers. It allows routers to perform high performance network layer switching. IP traffic flows between endpoints of a network are identified and switched on a connection-oriented basis. It identifies flows using both network and transport layer information allowing its Inter network Operating System (IOS) services to be applied on a per user, per application basis. NetFlow Switching examines the first packet of a flow and all subsequent packets are then handled on a connection oriented basis [18]. This significantly reduces the amount of IP processing required, improving performance. One advantage of NetFlow Switching is that it enables connection-less networks to provide the performance and services associated with a connection-oriented network. These services include improved security and traffic accounting.

V. Comparison Between Data Transport Technologies

For data transport, a broad range of wireless technologies are utilized by the electric companies to read meter data. Radio Frequency (RF), Wi-Fi, Bluetooth, and even cellular technologies are currently in use.

When using TCP for data transport, one need not worry about data loss. TCP guarantees delivery of packets by ordering the packets and asking for retransmission if they are lost along the way. The result is that TCP is slow. When using UDP, which is very fast, for transport, packets would occasionally be lost [19].

Acknowledgment

Not applicable.

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